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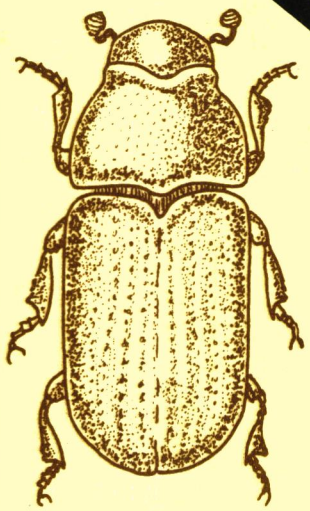
TECHNICAL REPORT R-3 76-22

SIMULATED YIELD TABLES FOR DWARF MISTLETOE MANAGEMENT IN PONDEROSA PINE STANDS (SWYLD2 PROGRAM)

Long Valley and Blue Ridge
Ranger Districts
Coconino National Forest
Arizona

1976



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TECHNICAL REPORT

SIMULATED YIELD TABLES FOR DWARF MISTLETOE MANAGEMENT IN PONDEROSA PINE STANDS (SWYLD2 PROGRAM)

PHASE I. YIELD TABLE SYNTHESIS: AN AID TO SILVICULTURAL PRESCRIPTIONS

Long Valley and Blue Ridge Ranger Districts
Coconino National Forest
Arizona

April 1976

Forest Insect and Disease Management
State and Private Forestry
Southwestern Region, Forest Service, USDA
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INTRODUCTION

Southwestern dwarf mistletoe (Arceuthobium vaginatum subsp. cryptopodum) is the most destructive disease of ponderosa pine in the Southwest. Dwarf mistletoe causes growth loss, mortality, deformity, and reduced seed production in infected trees. This disease often can be controlled by standard silvicultural treatments such as precommercial and commercial thinning as outlined in FSM 2476. In heavily-infested stands, sanitation thinning may be required to reduce mistletoe levels and to obtain an acceptable yield. The efficiency of suppression in mistletoe-infested stands depends on the intensity and frequency of cultural operations, as well as the initial stand conditions.

The timber volume reduction caused by dwarf mistletoe in an infested stand is difficult to assess by direct observation. Also, management alternatives that reduce dwarf mistletoe impact vary in their effectiveness. Researchers have developed a simulated yield program (SWYLD2) for use in even-aged and two-storied ponderosa pine stands (Myers, Edminster, and Hawksworth 1975). This program can be used in either dwarf mistletoe-infested or non-infested stands. The program aids the land manager by quantifying effects of dwarf mistletoe and effects of various silvicultural treatments on a mistletoe infestation. Yield tables generated by the program help the land manager evaluate management alternatives through examination of yields produced under such alternatives.

The SWYLD2 program is being evaluated for implementation in the Southwestern Region. Areas were selected in various parts of the Region for development of simulated yield tables in mistletoe-infested stands. The program for implementation of SWYLD2 consists of three phases: I. synthesis of yield tables for selected stands infested with dwarf mistletoe, II. evaluation of these stands managed with the aid of SWYLD2 simulations, and III. implementation of SWYLD2 in timber management programs of the Southwestern Region. This report is one of a series to be issued during the implementation process.

OBJECTIVE

The purpose of this project was to synthesize yield tables for even-aged, dwarf mistletoe-infested ponderosa pine stands on Long Valley and Blue Ridge Ranger Districts, Coconino National Forest. This report summarizes results for Phase I of the SWYLD2 implementation program on this Forest.

PROCEDURE

The following procedure constituted Phase I of this project:

1. Collect data necessary for input in the SWYLD2 program from two even-aged, dwarf mistletoe-infested ponderosa pine stands on Long Valley and Blue Ridge Ranger Districts.

2. Combine data with various management alternatives selected by the land manager and produce simulated yield tables for the sampled stand.

3. Assist land manager in interpreting the yield tables and selecting the best combination of management alternatives in a dwarf mistletoe-infested stand.

4. Assist land manager in planning implementation of selected management alternatives.

METHODS

Two stands of even-aged ponderosa pine infested with dwarf mistletoe were sampled in 1975 by personnel from the Forest Insect and Disease Management Staff Unit (Fig. 1 and 2). To facilitate understanding of the SWYLD2 program, even-aged stands were sampled because use of two-storied stands could double the number of management alternatives considered. Widely scattered overstory trees were present in the stands; however, they were not sampled because of their small numbers.

Sampling Procedure

1. The boundary of the area was marked.

2. Age measurements were obtained from 20 ponderosa pine trees representative of the average stand age.

3. Site index measurements were obtained from 12 dominant ponderosa pines within the area sampled.

4. Sample plots were located at 4-chain intervals along parallel compass lines 4 chains apart; the plots were of variable size with a maximum radius of 33 feet; each plot was divided into four quadrants by the intersection of a base line at right angles to the compass line; the third nearest live ponderosa pine tree (4.5 feet or taller) to plot center in each quadrant was sampled; distance from plot center to the third tree, d.b.h., and presence or absence of dwarf mistletoe were recorded for each "sample tree."[1/]

1/ A blackjack, 4.5 feet or taller, the third nearest live tree in the sample quadrant, and within 33 feet of plot center.

5. Survey data were first processed through the DENSUR computer program, which summarized field data and provided estimates of average tree density, average d.b.h., and percent of trees infected with dwarf mistletoe; the summarized data were combined with management alternatives obtained from Ranger District personnel and then processed through the simulated yield program SWYLD2.

RESULTS AND DISCUSSION

Results for each of the two areas are presented separately herein.

Long Valley Ranger District

A 171-acre stand of even-aged ponderosa pine on the Long Valley Ranger District was sampled by collecting data on 107 plots. Area sampled, line, plot, and dwarf mistletoe distribution are indicated in Figure 3. Plots with dwarf mistletoe had at least one infected sample tree. Plots with less than two sample trees were considered understocked and were not used in the data analysis. Deletion of these plots provided a more precise estimate of density (than when they were included) for the stand to be thinned. Summation of survey results:

Site index	71
Average age	59
Average number of trees/acre	538
Average d.b.h. (inches)	4.4
Percent trees infected with dwarf mistletoe	35

This basic stand information was combined with management alternatives selected by Ranger District personnel to produce 12 simulated yield tables. The yield tables were discussed and evaluated with Ranger District personnel. Five yield tables were selected as examples to be used in this report (Tables 1-5). Several important concepts are revealed by comparing the five yield tables.

Dwarf mistletoe (DMR - dwarf mistletoe rating based on 6-class system) increased from a low level (Tables 1 and 2) to moderate (Tables 3 and 4), and finally to a heavy infestation (Table 5). The increases in dwarf mistletoe resulted from variation in management alternatives. In Table 3, the thinning scheduled at age 80 was not completed because of insufficient available volume to meet the commercial minimums of 260 cubic feet (solid wood content), or 500 board feet per acre. Commercial minimums help the land manager specify the yield necessary to make an economically feasible stand entry. In essence, a subsequent thinning intensity of 100 (GSL - growing stock level = 100) did not yield 260 cubic feet of merchantable volume per acre. Because the thinning was not done, dwarf mistletoe increased and could not be effectively suppressed in subsequent stand entries.

A similar response occurred when the initial thinning intensity (GSL) was too high and the growing stock available for thinning was insufficient (Table 5). Delay of the initial stand entry resulted in a rapid buildup of dwarf mistletoe which could not be controlled by subsequent stand entries. Setting the GSL for initial and subsequent thinnings too high can also result in a buildup of mistletoe, even though all thinnings are completed (Table 4). A number of infected trees must be removed in each stand entry if dwarf mistletoe is to be controlled. The number of trees to be removed is directly related to DMR. Generally, enough trees should be removed in each entry to maintain a DMR of 1 or less. Thus, the SWYLD program can be used to assist land managers in determining the intensity of thinning required to maintain low levels of mistletoe. In some cases, reduction in total volume per acre was primarily due to tree mortality and growth loss caused by dwarf mistletoe (Tables 3-5). Variations in thinning intensity also contribute to volume reductions (Table 2). Examination of yield tables will aid land managers in selecting the combination of management alternatives that best meet current management objectives.

Blue Ridge Ranger District

A 117-acre stand of even-aged ponderosa pine on the Blue Ridge Ranger District was sampled by collecting data on 73 plots. Area sampled, line, plot, and dwarf mistletoe distribution are indicated in Figure 4. Summation of survey results:

Site index	63
Average age	41
Average number of trees/acre	2,032
Average d.b.h. (inches)	2.0
Percent trees infected with dwarf mistletoe	5

This basic stand information was combined with management alternatives selected by Ranger District personnel to produce 18 simulated yield tables. The yield tables were discussed and evaluated with Ranger District personnel. Five yield tables were selected as examples for use in this report (Tables 6-10). Several important concepts are revealed by comparing the five yield tables.

Simulated yields are based on a 20-year cutting cycle (Tables 6 and 8-10) with one exception (Table 7), which simulated a 10-year cutting cycle. The 10-year cycle did not allow sufficient volume accumulation to meet the specified commercial minimums of 260 cubic feet (solid wood volume), or 500 board feet per acre. Tables 6 and 8 are very similar, with the exception of the stand entry at age 100. This entry is an intermediate cut which is based on subsequent thinning intensity (Table 6), while a regeneration cut is simulated in Table 8. In two instances, when a 20-year cutting cycle was simulated, dwarf

mistletoe levels (DMR) increased because a scheduled thinning was not done (Tables 9 and 10); the volume available to meet specified commercial minimums was insufficient and the thinnings were bypassed.

Total per acre volume reduction resulted from dwarf mistletoe impact (Tables 9 and 10) and variations in thinning intensity, cutting cycle, and age or intensity of regeneration cuts (Tables 6-8). Use of simulated yield tables enables the land manager to quantify effects of various management alternatives. This, in turn, aids the land manager in selecting the alternatives that best meet current management objectives.

CONCLUSIONS AND RECOMMENDATIONS

Sufficient stand data were obtained on the Long Valley and Blue Ridge Ranger Districts for use of the simulated yield program SWYLD2. The data were combined with various management alternatives selected by Ranger District personnel, and yield tables were produced for each sample area. Examination of yield tables by the land manager and personnel from the Forest Insect and Disease Management Staff Unit revealed several important factors: (1) volume losses caused by dwarf mistletoe can be substantial when infested stands are improperly treated (FSM 5200); (2) control of dwarf mistletoe is dependent on management alternatives selected for use in a particular area; (3) total volume production per acre is dependent on management alternatives selected for use in a particular area.

The simulated yield program SWYLD2 is a potentially useful tool for land managers. The limits of this program will be revealed after on-the-ground situations in which simulated yield information has been used are compared with their simulated yields.

Based on results of this report, the following plan of action is recommended for areas sampled on Long Valley and Blue Ridge Ranger Districts:

1. Select the yield table and accompanying management alternatives that best meet current management objectives, while reducing dwarf mistletoe to acceptable levels (FSM 5260).

2. Implement the management alternatives selected for the first stand entry.

3. At the time of initial stand entry, or within 5 years thereafter, remove all mistletoe-infected overstory trees from the treated area.

4. With the assistance of personnel from the Forest Insect and Disease Management Staff Unit, complete a post-control evaluation of the area.

5. Compare results of the post-treatment evaluation with simulated yield predictions (Phase II).

Instructions for use of the SWYLD2 program and detailed descriptions of management alternatives are provided by Edminster and Hawksworth (1975). Additional information pertaining to the SWYLD2 program may be obtained by contacting the Forest Insect and Disease Management Staff Unit.

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Edminster, C. B., and F. G. Hawksworth. 1975. User's guide to SWYLD2: yield tables for even-aged and two-storied stands of southwestern ponderosa pine, including effects of dwarf mistletoe. In press.

Myers, C. A., C. B. Edminster, and F. G. Hawskworth. 1975. Yield tables for even-aged and two-storied stands of southwestern ponderosa pine, including effects of dwarf mistletoe. In press.

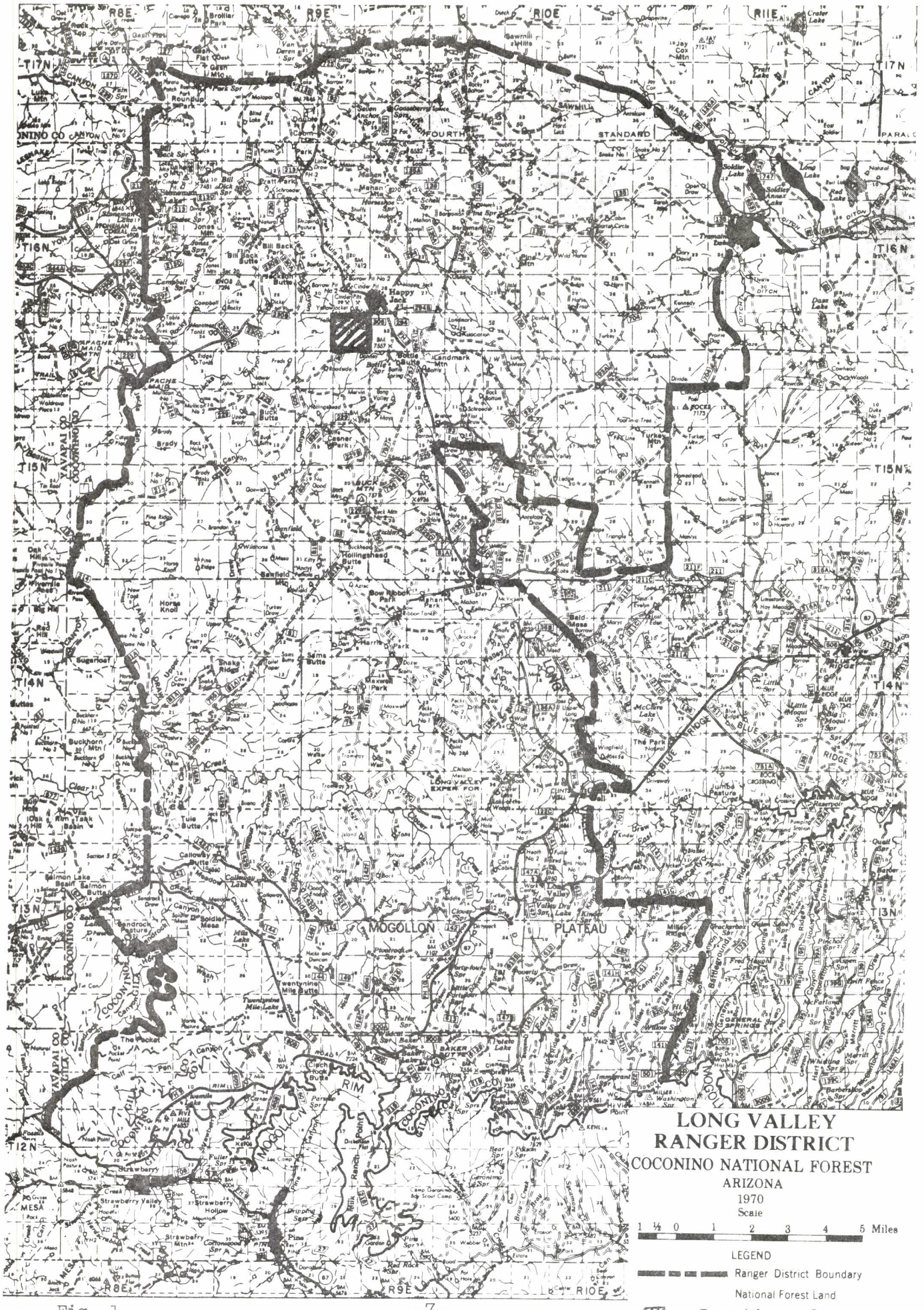
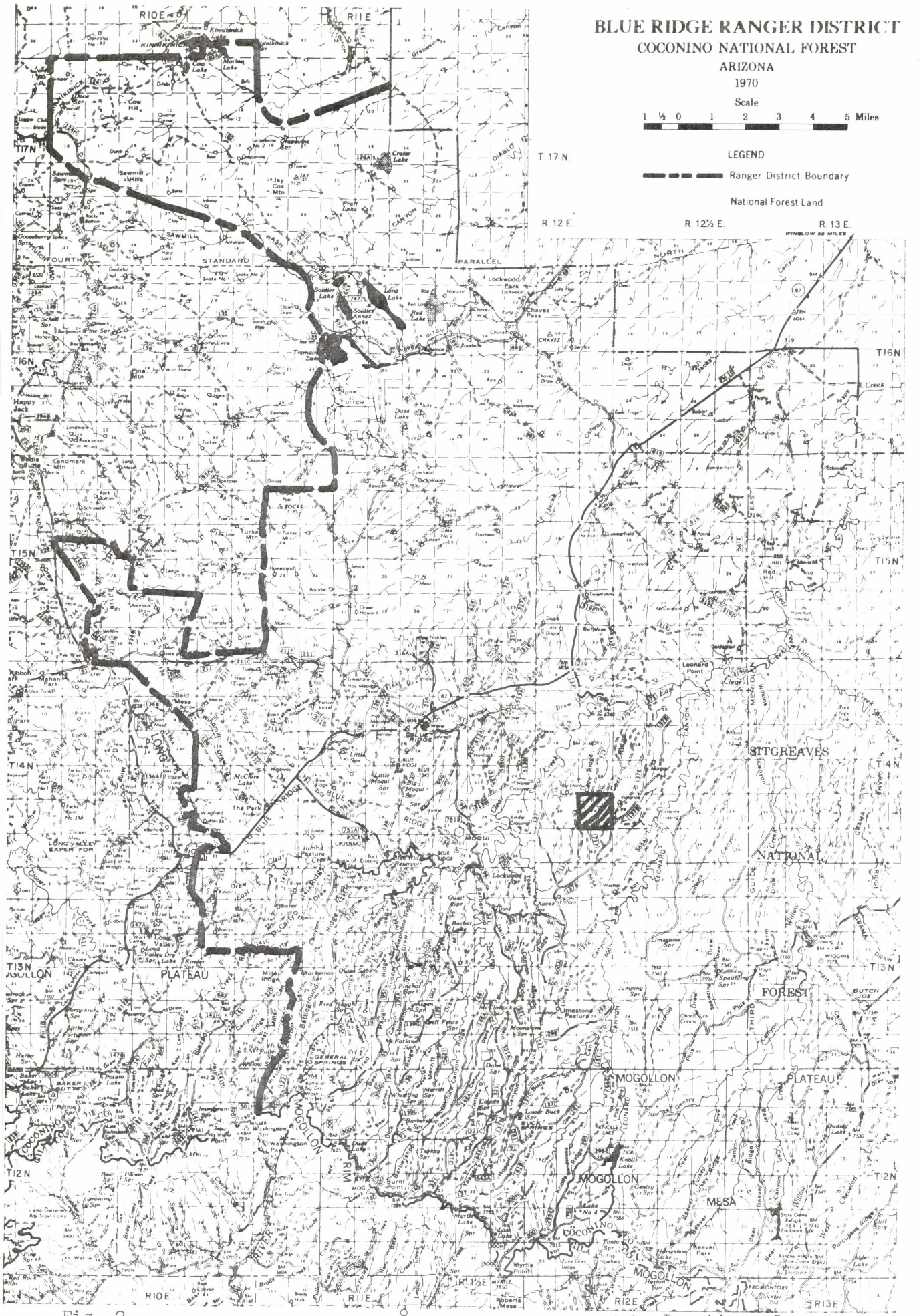

LONG VALLEY
RANGER DISTRICT
COCONINO NATIONAL FOREST
ARIZONA
1970
Scale
1 ½ 0 1 2 3 4 5 Miles
LEGEND
Ranger District Boundary
National Forest Land
- Location of survey area

Fig. 1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COCONINO NATIONAL FOREST
ARIZONA
1970
Scale
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LEGEND
Ranger District Boundary
National Forest Land
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R. 12 E.
R. 12½ E.
R. 13 E.
WINSLOW 88 MILES
T17N
T16N
T15N
T14N
T13N
T12N
R11E
R12E
R13E
STANDARD PARALLEL NORTH
SITGREAVES NATIONAL FOREST
MOGOLLON PLATEAU
MOGOLLON RIM
MOGOLLON MESA
COCONINO RIM
BLUE RIDGE
LONG VALLEY
Lockwood Park
Chavez Pass
Soldier Lake
Long Lake
Red Lake
Tremaine Lake
Crater Lake
Pratt Lake
Jay Cox Mtn
Sawmill Hills
Cow Lake
Horse Lake
Kinnikinick Lake
Cow Hill
Sawmill Spr.
Happy Jack
Landmark Mtn
Bald Mesa
The Park
McClure Lake
Little Spr.
Big Moqui Spr.
Jumbo Pasture Creek
Long Valley Dry Lake
Miller Ridge
Limestone Pasture
Leonard Point
Willow Creek
Clear Creek
Chavez Canyon
Pumpkin Spr.
Barber Lake
Quail Spr.
Pinchot Spr.
Jumping Spr.
Spaulding Spr.
Wiggins
Dutch Joe
Knolls Lake
Burnt Point
Myrtle Lake
Myrtle Point
Roberts Mesa
Beaver Park
Hidden Lake
Promontory
Tonto Spr.
Hidden Spr.
Centry Spr.
Willows
Washington Park
Mt. Fatland
Pilson
Baker Butte
Flake Lake
Kendrick Peak
Red Rock
Brady Hills
Broadway Reservoir
Jumbo Pasture Reservoir
Limestone Canyon
Chavez Canyon
Leonard Canyon
Third Fork
Willow Creek
Clear Creek
Meridian
Grama Ridge
Diablo Canyon
Sawmill Wash
Canyon
Creek
Ridge
Mesa
Hill
Spr.
Lake
Tank
Draw
Pass
Butte
Mtn
Park
Valley
Meadow
Forest
Plateau
Rim
Reservoir
Crossing
Headquarters
Campground
Cabins
Lookout
Station
Trail
Road
Fence
Ditch
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Refraction
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Cornea
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Iris
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Nerve
Brain
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Illusion
Hallucination
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Sleep
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Decision
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Creativity
Intelligence
Emotion
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Mood
Personality
Trait
Behavior
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Reaction
Response
Stimulus
Motivation
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Desire
Goal
Value
Belief
Attitude
Opinion
Perception
Culture
Society
Group
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Person
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Animal
Plant
Organism
Cell
Tissue
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System
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Illness
Injury
Treatment
Medicine
Drug
Therapy
Prevention
Diagnosis
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Correlation
Coefficient
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Intercept
Line
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Function
Derivative
Integral
Limit
Series
Sequence
Convergence
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Vector
Matrix
Determinant
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Eigenvector
Transformation
Rotation
Reflection
Translation
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Projection
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Dimension
Coordinate
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Cartesian
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Geometry
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Figure
Triangle
Square
Rectangle
Circle
Ellipse
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Polygon
Polyhedron
Cube
Sphere
Cone
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Angle
Side
Vertex
Edge
Face
Surface
Area
Perimeter
Circumference
Diameter
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Capacity
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Free
Rider
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Coordination
Problem
Bargaining
Problem
Auction
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Mechanism
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Choice
Theory
Arrow's
Impossibility
Theorem
Condorcet
Paradox
Voting
Theory
Plurality
Rule
Majority
Rule
Proportional
Representation
Gerrymandering
Redistricting
Census
Demography
Population
Growth
Migration
Urbanization
Suburbanization
Gentrification
Segregation
Integration
Diversity
Inclusion
Equity
Justice
Rights
Freedom
Liberty
Equality
Democracy
Republic
Monarchy
Dictatorship
Totalitarianism
Authoritarianism
Anarchism
Socialism
Capitalism
Communism
Fascism
Nationalism
Globalization
Trade
Tariff
Quota
Embargo
Sanction
War
Peace
Treaty
Alliance
Diplomacy
Negotiation
Conflict
Resolution
Mediation
Arbitration
Litigation
Court
Judge
Jury
Lawyer
Prosecutor
Defendant
Plaintiff
Verdict
Sentence
Appeal
Precedent
Statute
Regulation
Constitution
Amendment
Bill
of
Rights
Due
Process
Habeas
Corpus
Miranda
Rights
Search
and
Seizure
Warrant
Probable
Cause
Reasonable
Doubt
Burden
of
Proof
Presumption
of
Innocence
Double
Jeopardy
Self-incrimination
Cruel
and
Unusual
Punishment
Death
Penalty
Capital
Punishment
Life
Imprisonment
Parole
Probation
Rehabilitation
Deterrence
Retribution
Restitution
Victim
Impact
Statement
Plea
Bargain
Grand
Jury
Indictment
Arraignment
Trial
Deliberation
Hung
Jury
Mistrial
Acquittal
Conviction
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Mandatory
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Three
Strikes
Law
Truth
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Sentencing
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Megan's
Law
Jessica's
Law
Amber
Alert
Silver
Alert
Missing
Persons
Cold
Case
Forensic
Science
Fingerprint
DNA
Evidence
Ballistics
Autopsy
Coroner
Medical
Examiner
Toxicology
Pathology
Anthropology
Archaeology
Paleontology
Geology
Mineralogy
Petrology
Stratigraphy
Fossil
Dinosaur
Mammal
Bird
Reptile
Amphibian
Fish
Insect
Arthropod
Mollusk
Echinoderm
Cnidarian
Porifera
Protozoa
Bacteria
Archaea
Virus
Prion
Fungus
Yeast
Mold
Mushroom
Lichen
Moss
Fern
Conifer
Flowering
Plant
Tree
Shrub
Grass
Herb
Vine
Root
Stem
Leaf
Flower
Fruit
Seed
Pollen
Ovule
Stamen
Pistil
Petal
Sepal
Bud
Inflorescence
Pollination
Fertilization
Germination
Dormancy
Photosynthesis
Chlorophyll
Carotenoid
Anthocyanin
Xylem
Phloem
Cambium
Epidermis
Cortex
Pith
Vascular
Bundle
Stomata
Guard
Cell
Transpiration
Osmosis
Diffusion
Active
Transport
Passive
Transport
Membrane
Cell
Wall
Cytoplasm
Nucleus
Mitochondrion
Chloroplast
Ribosome
Endoplasmic
Reticulum
Golgi
Apparatus
Vacuole
Lysosome
Peroxisome
Cytoskeleton
Microtubule
Microfilament
Intermediate
Filament
Centriole
Flagellum
Cilium
Prokaryote
Eukaryote
Unicellular
Multicellular
Colony
Tissue
Organ
System
Organism
Species
Genus
Family
Order
Class
Phylum
Kingdom
Domain
Taxonomy
Phylogeny
Cladistics
Clade
Monophyletic
Paraphyletic
Polyphyletic
Ancestor
Descendant
Common
Ancestor
Last
Universal
Common
Ancestor
Tree
of
Life
Evolutionary
Tree
Phylogenetic
Tree
Molecular
Clock
Fossil
Record
Transitional
Fossil
Living
Fossil
Extinction
Mass
Extinction
Cretaceous-Paleogene
Boundary
Permian-Triassic
Boundary
Triassic-Jurassic
Boundary
Holocene
Extinction
Anthropocene
Geologic
Time
Scale
Era
Period
Epoch
Age
Eon
Precambrian
Paleozoic
Mesozoic
Cenozoic
Cambrian
Ordovician
Silurian
Devonian
Carboniferous
Permian
Triassic
Jurassic
Cretaceous
Paleogene
Neogene
Quaternary
Pleistocene
Holocene
Plate
Tectonics
Continental
Drift
Pangaea
Laurasia
Gondwana
Rodinia
Supercontinent
Cycle
Mantle
Convection
Subduction
Zone
Mid-ocean
Ridge
Transform
Fault
Convergent
Boundary
Divergent
Boundary
Oceanic
Crust
Continental
Crust
Lithosphere
Asthenosphere
Mantle
Core
Earthquake
Seismology
Seismograph
Seismic
Wave
Primary
Wave
Secondary
Wave
Surface
Wave
Epicenter
Focus
Hypocenter
Magnitude
Richter
Scale
Moment
Magnitude
Scale
Mercalli
Intensity
Scale
Volcano
Volcanology
Magma
Lava
Ash
Pyroclastic
Flow
Lahar
Caldera
Crater
Vent
Fissure
Shield
Volcano
Stratovolcano
Cinder
Cone
Lava
Dome
Hotspot
Island
Arc
Ring
of
Fire
Tsunami
Landslide
Avalanche
Erosion
Weathering
Mechanical
Weathering
Chemical
Weathering
Frost
Wedging
Exfoliation
Abrasion
Deflation
Hydraulic
Action
Solution
Carbonation
Oxidation
Hydrolysis
Soil
Horizon
Topsoil
Subsoil
Bedrock
Regolith
Sediment
Sedimentary
Rock
Clastic
Rock
Conglomerate
Breccia
Sandstone
Shale
Mudstone
Siltstone
Limestone
Dolomite
Chert
Coal
Evaporite
Gypsum
Halite
Igneous
Rock
Intrusive
Extrusive
Granite
Basalt
Gabbro
Diorite
Andesite
Rhyolite
Obsidian
Pumice
Tuff
Porphyry
Pegmatite
Metamorphic
Rock
Foliation
Slate
Phyllite
Schist
Gneiss
Migmatite
Marble
Quartzite
Hornfels
Skarn
Greenschist
Amphibolite
Granulite
Eclogite
Blueschist
Contact
Metamorphism
Regional
Metamorphism
Hydrothermal
Alteration
Ore
Deposit
Mineral
Rock-forming
Mineral
Silicate
Quartz
Feldspar
Mica
Amphibole
Pyroxene
Olivine
Garnet
Clay
Carbonate
Calcite
Aragonite
Oxide
Hematite
Magnetite
Ilmenite
Sulfide
Pyrite
Galena
Sphalerite
Chalcopyrite
Native
Element
Gold
Silver
Copper
Diamond
Graphite
Sulfur
Halide
Fluorite
Halite
Sylvite
Phosphate
Apatite
Sulfate
Barite
Gypsum
Anhydrite
Tungstate
Wolframite
Scheelite
Molybdenite
Cassiterite
Bauxite
Laterite
Kaolinite
Gibbsite
Hematite
Goethite
Limonite
Pisolite
Oolite
Fossiliferous
Limestone
Chalk
Coquina
Travertine
Tufa
Caliche
Calcrete
Dolostone
Reef
Coral
Algae
Stromatolite
Microbialite
Carbonate
Platform
Atoll
Barrier
Reef
Fringing
Reef
Lagoon
Back-reef
Fore-reef
Reef
Crest
Reef
Flat
Reef
Slope
Reef
Framework
Reef
Builder
Reef
Destroyer
Bioerosion
Bioconstruction
Carbonate
Sediment
Grain
Mud
Lime
Mud
Micrite
Sparite
Peloid
Ooid
Oncoid
Intraclast
Extraclast
Bioclast
Skeletal
Grain
Foraminifera
Nummulite
Fusulinid
Rugose
Coral
Tabulate
Coral
Scleractinian
Coral
Hexacoral
Octocoral
Sponge
Bryozoan
Brachiopod
Articulate
Inarticulate
Crinoid
Echinoid
Asteroid
Ophiuroid
Holothuroid
Mollusk
Bivalve
Gastropod
Cephalopod
Ammonite
Nautiloid
Belemnite
Trilobite
Ostracod
Conodont
Graptolite
Arthropod
Crustacean
Insect
Vertebrate
Fish
Amphibian
Reptile
Bird
Mammal
Dinosaur
Theropod
Sauropod
Ornithopod
Ceratopsian
Stegosaur
Ankylosaur
Pterosaur
Plesiosaur
Ichthyosaur
Mosasaur
Crocodile
Turtle
Snake
Lizard
Frog
Salamander
Caecilian
Primate
Human
Hominin
Australopithecine
Homo
Neanderthal
Denisovan
Homo
sapiens
Paleolithic
Mesolithic
Neolithic
Bronze
Age
Iron
Age
Classical
Antiquity
Ancient
Greece
Ancient
Rome
Byzantine
Empire
Middle
Ages
Renaissance
Reformation
Enlightenment
Industrial
Revolution
Modern
Era
Contemporary
Era
Information
Age
Digital
Age
Space
Age
Nuclear
Age
Atomic
Age
Cold
War
World
War
I
World
War
II
Holocaust
Genocide
Civil
War
Revolution
Independence
Colonialism
Imperialism
Decolonization
Post-colonialism
Neo-colonialism
Globalization
Multinational
Corporation
Trade
Agreement
World
Trade
Organization
International
Monetary
Fund
World
Bank
United
Nations
European
Union
NATO
Warsaw
Pact
Cold
War
Proxy
War
Arms
Race
Nuclear
Weapon
Deterrence
Mutually
Assured
Destruction
Non-proliferation
Treaty
Test
Ban
Treaty
Strategic
Arms
Limitation
Talks
Intermediate-Range
Nuclear
Forces
Treaty
New
START
Comprehensive
Nuclear-Test-Ban
Treaty
Chemical
Weapons
Convention
Biological
Weapons
Convention
Geneva
Protocol
Hague
Convention
Laws
of
War
International
Humanitarian
Law
Human
Rights
Universal
Declaration
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Human
Rights
International
Criminal
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Crimes
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Humanity
Genocide
Convention
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Truth
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Unitary
State
Confederation
Federation
Devolution
Subsidiarity
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Government
Municipality
County
State
Province
Region
Capital
City
Urban
Planning
Zoning
Land
Use
Transportation
Infrastructure
Public
Works
Utility
Water
Supply
Sewage
Waste
Management
Recycling
Landfill
Incineration
Composting
Hazardous
Waste
Toxic
Waste
Superfund
Site
Brownfield
Greenfield
Sustainable
Development
Green
Building
Renewable
Energy
Solar
Power
Wind
Power
Hydroelectric
Power
Geothermal
Energy
Biomass
Biofuel
Nuclear
Power
Fossil
Fuel
Coal
Oil
Natural
Gas
Petroleum
Refinery
Pipeline
Tanker
Drilling
Fracking
Shale
Oil
Tar
Sands
Oil
Spill
Environmental
Impact
Assessment
Environmental
Protection
Agency
Clean
Air
Act
Clean
Water
Act
Endangered
Species
Act
National
Park
Wilderness
Area
Conservation
Biodiversity
Habitat
Loss
Deforestation
Desertification
Soil
Erosion
Overgrazing
Overfishing
Pollution
Air
Pollution
Water
Pollution
Soil
Pollution
Noise
Pollution
Light
Pollution
Thermal
Pollution
Radioactive
Pollution
Plastic
Pollution
Microplastic
Ocean
Acidification
Climate
Change
Global
Warming
Greenhouse
Gas
Carbon
Dioxide
Methane
Nitrous
Oxide
Fluorinated
Gas
Ozone
Layer
Ozone
Hole
Montreal
Protocol
Kyoto
Protocol
Paris
Agreement
Carbon
Tax
Cap
and
Trade
Carbon
Offset
Carbon
Footprint
Ecological
Footprint
Sustainability
Resilience
Adaptation
Mitigation
Geoengineering
Solar
Radiation
Management
Carbon
Capture
and
Storage
Afforestation
Reforestation
Ocean
Fertilization
Albedo
Modification
Cloud
Seeding
Weather
Modification
Meteorology
Climatology
Atmosphere
Troposphere
Stratosphere
Mesosphere
Thermosphere
Exosphere
Ionosphere
Magnetosphere
Solar
Wind
Aurora
Borealis
Aurora
Australis
Jet
Stream
Hadley
Cell
Ferrel
Cell
Polar
Cell
Coriolis
Effect
Trade
Wind
Westerly
Polar
Easterly
Monsoon
El
Niño
La
Niña
Southern
Oscillation
Pacific
Decadal
Oscillation
Atlantic
Multidecadal
Oscillation
North
Atlantic
Oscillation
Arctic
Oscillation
Antarctic
Oscillation
Indian
Ocean
Dipole
Madden-Julian
Oscillation
Quasi-biennial
Oscillation
Sunspot
Solar
Cycle
Solar
Flare
Coronal
Mass
Ejection
Geomagnetic
Storm
Van
Allen
Belt
Cosmic
Ray
Neutrino
Dark
Matter
Dark
Energy
Universe
Big
Bang
Cosmic
Microwave
Background
Inflation
Expansion
of
the
Universe
Hubble's
Law
Redshift
Blueshift
Doppler
Effect
Galaxy
Milky
Way
Andromeda
Galaxy
Local
Group
Galaxy
Cluster
Supercluster
Filament
Void
Large-scale
Structure
Star
Stellar
Evolution
Nebula
Protostar
Main
Sequence
Red
Giant
White
Dwarf
Neutron
Star
Pulsar
Black
Hole
Supernova
Hypernova
Gamma-ray
Burst
Binary
Star
Variable
Star
Cepheid
Variable
RR
Lyrae
Variable
Mira
Variable
Eclipsing
Binary
Spectroscopic
Binary
Astrometric
Binary
Visual
Binary
Open
Cluster
Globular
Cluster
Stellar
Association
Interstellar
Medium
Molecular
Cloud
Star
Formation
Initial
Mass
Function
Hertzsprung-Russell
Diagram
Color-Magnitude
Diagram
Luminosity
Class
Spectral
Type
O
B
A
F
G
K
M
L
T
Y
Brown
Dwarf
Planetary
Nebula
Wolf-Rayet
Star
Carbon
Star
S-type
Star
Barium
Star
Technetium
Star
Post-AGB
Star
Horizontal
Branch
Star
Blue
Straggler
Subdwarf
Extreme
Helium
Star
Hot
Subdwarf
Blue
Hook
Star
Asymptotic
Giant
Branch
Star
Thermally
Pulsing
AGB
Star
Carbon-enhanced
Metal-poor
Star
Population
I
Star
Population
II
Star
Population
III
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Abundance
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Bang
Nucleosynthesis
Stellar
Nucleosynthesis
Supernova
Nucleosynthesis
Neutron
Capture
Process
Rapid
Process
Slow
Process
Proton-proton
Chain
CNO
Cycle
Triple-alpha
Process
Carbon-burning
Process
Neon-burning
Process
Oxygen-burning
Process
Silicon-burning
Process
Iron
Peak
Element
Light
Element
Heavy
Element
Actinide
Lanthanide
Transuranic
Element
Isotope
Radioisotope
Half-life
Decay
Alpha
Decay
Beta
Decay
Gamma
Decay
Electron
Capture
Positron
Emission
Spontaneous
Fission
Neutron
Emission
Proton
Emission
Cluster
Decay
Internal
Conversion
Isomeric
Transition
Nuclear
Reaction
Fusion
Fission
Nuclear
Binding
Energy
Mass
Defect
Nuclear
Force
Strong
Force
Weak
Force
Electromagnetic
Force
Gravity
Fundamental
Force
Gauge
Boson
Photon
Gluon
W
Boson
Z
Boson
Higgs
Boson
Graviton
Quark
Up
Down
Charm
Strange
Top
Bottom
Lepton
Electron
Muon
Tau
Neutrino
Electron
Neutrino
Muon
Neutrino
Tau
Neutrino
Antimatter
Positron
Antiproton
Antineutron
Antiquark
Antilepton
Pair
Production
Annihilation
Baryon
Meson
Hadron
Exotic
Hadron
Tetraquark
Pentaquark
Glueball
Hybrid
Meson
Quark-gluon
Plasma
Color
Charge
Confinement
Asymptotic
Freedom
Quantum
Chromodynamics
Quantum
Electrodynamics
Quantum
Field
Theory
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the
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Heisenberg
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Quantum
Superposition
Quantum
Entanglement
Quantum
Tunneling
Quantum
Decoherence
Quantum
Measurement
Copenhagen
Interpretation
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Gate
Quantum
Circuit
Quantum
Algorithm
Shor's
Algorithm
Grover's
Algorithm
Quantum
Error
Correction
Quantum
Cryptography
Quantum
Key
Distribution
Quantum
Teleportation
Quantum
Simulation
Quantum
Supremacy
Quantum
Advantage
Quantum
Annealing
Adiabatic
Quantum
Computation
Topological
Quantum
Computation
Anyon
Majorana
Fermion
Quantum
Dot
Quantum
Well
Quantum
Wire
Quantum
Confinement
Quantum
Hall
Effect
Integer
Quantum
Hall
Effect
Fractional
Quantum
Hall
Effect
Spin
Hall
Effect
Quantum
Spin
Hall
Effect
Topological
Insulator
Topological
Superconductor
Superconductivity
Cooper
Pair
BCS
Theory
Type
I
Superconductor
Type
II
Superconductor
Vortex
Flux
Quantization
Josephson
Effect
Josephson
Junction
SQUID
Superfluidity
Helium-3
Helium-4
Bose-Einstein
Condensate
Fermi
Gas
Degenerate
Matter
Electron
Degeneracy
Pressure
Neutron
Degeneracy
Pressure
Chandrasekhar
Limit
Tolman-Oppenheimer-Volkoff
Limit
Schwarzschild
Radius
Event
Horizon
Singularity
Penrose
Process
Hawking
Radiation
Black
Hole
Thermodynamics
Information
Paradox
Firewall
Paradox
Holographic
Principle
AdS/CFT
Correspondence
Ryu-Takayanagi
Formula
Quantum
Gravity
Loop
Quantum
Gravity
Causal
Set
Theory
Asymptotic
Safety
Emergent
Gravity
Entropic
Gravity
Modified
Newtonian
Dynamics
Tensor-vector-scalar
Gravity
Scalar-tensor
Theory
Brans-Dicke
Theory
Kaluza-Klein
Theory
Extra
Dimension
Brane
Cosmology
Randall-Sundrum
Model
Large
Extra
Dimensions
Warped
Extra
Dimension
Conformal
Field
Theory
Anti-de
Sitter
Space
Holography
Entanglement
Entropy
Tensor
Network
Renormalization
Group
Effective
Field
Theory
Wilsonian
Renormalization
Ultraviolet
Cutoff
Infrared
Cutoff
Fixed
Point
Critical
Point
Phase
Transition
Order
Parameter
Symmetry
Breaking
Goldstone
Boson
Higgs
Mechanism
Spontaneous
Symmetry
Breaking
Explicit
Symmetry
Breaking
Anomaly
Chiral
Anomaly
Gauge
Anomaly
Gravitational
Anomaly
Mixed
Anomaly
Global
Anomaly
Local
Anomaly
Anomaly
Cancellation
Green-Schwarz
Mechanism
Heterotic
String
Theory
Type
I
String
Theory
Type
II
String
Theory
Open
String
Closed
String
D-brane
Orientifold
M-theory
Eleven-dimensional
Supergravity
Calabi-Yau
Manifold
Compactification
Moduli
Flux
Compactification
Landscape
Swampland
Cosmic
Censorship
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Wormhole
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Travel
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Timelike
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Protection
Conjecture
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Warp
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Exotic
Matter
Negative
Energy
Casimir
Effect
Vacuum
Energy
Cosmological
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Fine-tuning
Problem
Hierarchy
Problem
Naturalness
Problem
Strong
CP
Problem
Axion
Peccei-Quinn
Mechanism
Dark
Matter
Candidate
WIMP
Sterile
Neutrino
Primordial
Black
Hole
MACHO
Baryonic
Dark
Matter
Cold
Dark
Matter
Warm
Dark
Matter
Hot
Dark
Matter
Self-interacting
Dark
Matter
Fuzzy
Dark
Matter
Modified
Gravity
Dark
Energy
Quintessence
Phantom
Energy
Chameleon
Field
Screening
Mechanism
Vainshtein
Mechanism
Symmetron
Field
f(R)
Gravity
Palatini
Formalism
Metric
Formalism
Affine
Connection
Levi-Civita
Connection
Christoffel
Symbol
Riemann
Curvature
Tensor
Ricci
Curvature
Ricci
Scalar
Einstein
Tensor
Stress-energy
Tensor
Perfect
Fluid
Dust
Radiation
Cosmological
Constant
Friedmann
Equation
Friedmann-Lemaître-Robertson-Walker
Metric
Cosmological
Principle
Homogeneity
Isotropy
Perfect
Cosmological
Principle
Steady
State
Theory
Big
Bang
Theory
Hot
Big
Bang
Cosmic
Inflation
Slow-roll
Inflation
Eternal
Inflation
Multiverse
Bubble
Universe
Pocket
Universe
Anthropic
Principle
Weak
Anthropic
Principle
Strong
Anthropic
Principle
Final
Anthropic
Principle
Participatory
Anthropic
Principle
Fine-tuning
Cosmological
Natural
Selection
Baby
Universe
Black
Hole
Cosmology
Primordial
Nucleosynthesis
Recombination
Era
Reionization
Era
Dark
Ages
Cosmic
Microwave
Background
Anisotropy
Sachs-Wolfe
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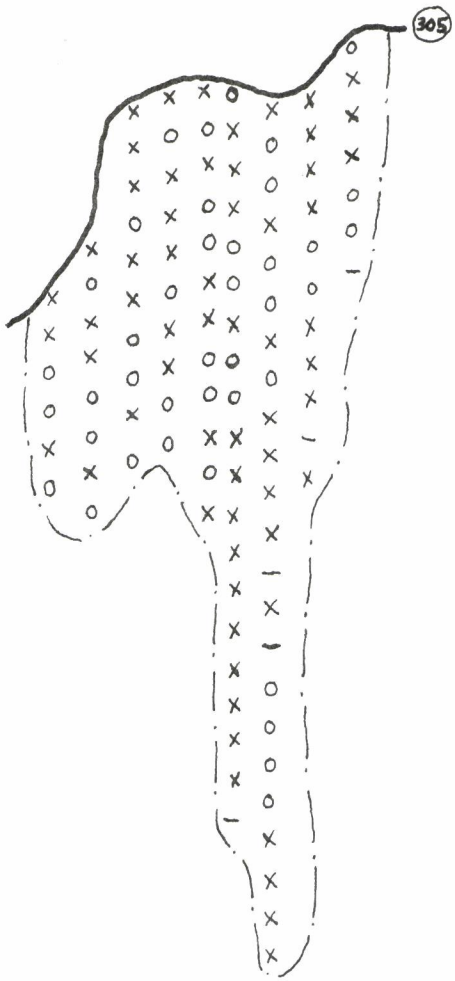
Integrated
Sachs-Wolfe
Effect
Baryon
Acoustic
Oscillation
Silk
Damping
Matter
Power
Spectrum
Transfer
Function
Growth
Factor
Peculiar
Velocity
Redshift-space
Distortion
Weak
Gravitational
Lensing
Strong
Gravitational
Lensing
Microlensing
Einstein
Ring
Einstein
Cross
Gravitational
Arc
Gravitational
Time
Delay
Shear
Convergence
Magnification
Tomography
Galaxy
Survey
Redshift
Survey
Photometric
Redshift
Spectroscopic
Redshift
Hubble
Constant
Tension
Sound
Horizon
Standard
Ruler
Standard
Candle
Type
Ia
Supernova
Cepheid
Variable
Tully-Fisher
Relation
Faber-Jackson
Relation
Fundamental
Plane
Galaxy
Morphology
Hubble
Sequence
Elliptical
Galaxy
Spiral
Galaxy
Barred
Spiral
Galaxy
Lenticular
Galaxy
Irregular
Galaxy
Dwarf
Galaxy
Ultra-diffuse
Galaxy
Active
Galactic
Nucleus
Quasar
Seyfert
Galaxy
Blazar
BL
Lacertae
Object
Radio
Galaxy
Starburst
Galaxy
Luminous
Infrared
Galaxy
Ultraluminous
Infrared
Galaxy
Merger
Galaxy
Interaction
Tidal
Tail
Bridge
Ring
Galaxy
Polar
Ring
Galaxy
Shell
Galaxy
Cannibal
Galaxy
Galactic
Cannibalism
Galactic
Halo
Galactic
Disk
Galactic
Bulge
Galactic
Nucleus
Supermassive
Black
Hole
Intermediate-mass
Black
Hole
Stellar-mass
Black
Hole
Galactic
Center
Sagittarius
A*
Galactic
Plane
Galactic
Coordinates
Galactic
Rotation
Curve
Dark
Matter
Halo
Galactic
Archaeology
Galactic
Chemical
Evolution
Galactic
Dynamics
Galactic
Potential
Jeans
Equation
Virial
Theorem
Collisionless
Boltzmann
Equation
Distribution
Function
Phase
Space
Action-angle
Variables
Orbit
Resonance
Lindblad
Resonance
Corotation
Resonance
Spiral
Density
Wave
Bar
Instability
Disk
Instability
Toomre
Stability
Criterion
Jeans
Instability
Gravitational
Instability
Star
Cluster
Open
Cluster
Globular
Cluster
Stellar
Association
Moving
Group
Tidal
Stream
Stellar
Stream
Galactic
Archaeology
Chemical
Tagging
Abundance
Gradient
Metallicity
Gradient
Age-metallicity
Relation
Star
Formation
History
Color-Magnitude
Diagram
Hertzsprung-Russell
Diagram
Main
Sequence
Turnoff
Subgiant
Branch

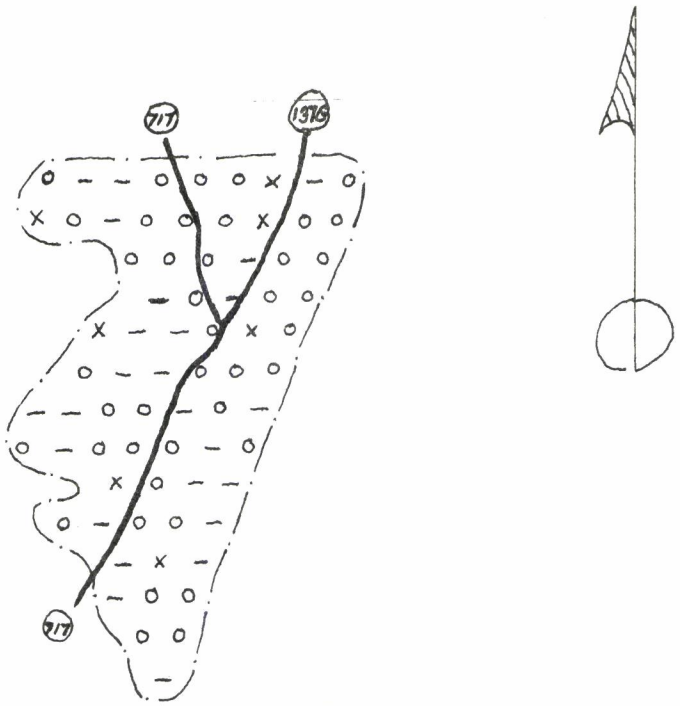


107 plots
171 acres

Scale: approx. 1 cm = 8 chains

Fig. 3.--Dwarf mistletoe survey plot distribution, Long Valley Ranger District.

LEGEND
×Plots with dwarf mistletoe
oPlots with no dwarf mistletoe
- Understocked plots
—·— Survey area boundary
◯ Forest road



73 plots
117 acres

Scale: approx. 1 cm = 8 chains

Fig. 4.--Dwarf mistletoe survey plot distribution, Blue Ridge Ranger District.

LEGEND
× Plots with dwarf mistletoe
o Plots with no dwarf mistletoe
– Understocked plots
—·— Survey area boundary
◯ Forest road

YIELDS PER ACRE OF SOUTHWESTERN PONDEROSA PINE, STAND NUMBER 2.

SITE INDEX 71
THINNING INTENSITY-- INITIAL- 90, SUBSEQUENT- 90,

COCONINO NF LONG VALLEY RD YELLOWJACKET BEFORE THINNING 1975

CHARACTERISTICS BEFORE AND AFTER THINNING									PERIODIC INTERMEDIATE CUTS				
STAND AGE (YEARS)	DMR	TREES NO.	BASAL AREA SQ.FT.	AVERAGE D.B.H. IN.	AVERAGE HEIGHT FT.	TOTAL VOLUME CU.FT.	MERCHANTABLE VOLUME CU.FT.	SAWTIMBER VOLUME BD.FT.	TREES NO.	BASAL AREA SQ.FT.	TOTAL VOLUME CU.FT.	MERCHANTABLE VOLUME CU.FT.	SAWTIMBER VOLUME BD.FT.
60	.4	538	57	4.4	50	1230	0	0					
60	.0	411	47	4.6	50	1010	0	0	127	10	220	0	0
70	.2	409	80	6.0	57	1740	870	0					
80	.2	405	108	7.0	63	2470	1740	0					
80	.0	262	76	7.3	64	1740	1290	0	143	32	730	450	0
90	.1	260	100	8.4	69	2400	2010	1400					
100	.2	258	122	9.3	73	3220	2830	4300					
100	.0	178	89	9.6	73	2390	2110	3500	80	33	830	720	800
110	.1	177	108	10.6	77	3090	2800	7400					
120	.1	177	128	11.5	80	3820	3500	12700					
120	.0	58	54	13.1	82	1670	1550	5900	119	74	2150	1950	6800
130	.1	58	67	14.5	85	2130	2010	8100					
140	.1	58	79	15.8	87	2610	2480	10700					
140	.0	16	27	17.7	89	930	890	4200	42	52	1680	1590	6500
150	.1	16	34	19.6	92	1170	1130	5700					
160	.1	16	40	21.4	94	1430	1390	7500					
							TOTAL YIELDS				7040	6100	21600

MERCH. CU. FT. - TREES 6.0 INCHES D.B.H. AND LARGER TO 4.0-INCH TOP.
BD. FT. - TREES 10.0 INCHES D.B.H. AND LARGER TO VARIABLE TOP LIMIT.
INITIAL THINNING MUST BE FROM BELOW.
DWARF MISTLETOE RATING ABOVE WHICH PERIODIC THINNINGS WILL NOT BE EXECUTED - 3.0.
MINIMUM CUTS FOR INCLUSION IN TOTAL YIELDS-- 260. CUBIC FEET AND 500. BOARD FEET.
PRECOMMERCIAL INITIAL THINNING ALLOWED, NONCOMMERCIAL SUBSEQUENT THINNINGS NOT ALLOWED.
AT INITIAL AGE 60., 35. PERCENT OF THE TREES WERE INFECTED WITH DWARF MISTLETOE.

Table 1

YIELDS PER ACRE OF SOUTHWESTERN PONDEROSA PINE, STAND NUMBER 2.

SITE INDEX 71
THINNING INTENSITY-- INITIAL- 80. SUBSEQUENT- 90.

COCONINO NF LONG VALLEY RD YELLOWJACKET BEFORE THINNING 1975

CHARACTERISTICS BEFORE AND AFTER THINNING									PERIODIC INTERMEDIATE CUTS				
STAND AGE (YEARS)	DMR	TREES NO.	BASAL AREA SQ.FT.	AVERAGE D.B.H. IN.	AVERAGE HEIGHT FT.	TOTAL VOLUME CU.FT.	MERCHANTABLE VOLUME CU.FT.	SAWTIMBER VOLUME BD.FT.	TREES NO.	BASAL AREA SQ.FT.	TOTAL VOLUME CU.FT.	MERCHANTABLE VOLUME CU.FT.	SAWTIMBER VOLUME BD.FT.
60	.4	538	57	4.4	50	1230	0	0					
60	.0	360	43	4.7	51	920	0	0	178	14	310	0	0
70	.2	358	73	6.1	57	1570	830	0					
80	.2	355	100	7.2	63	2280	1670	0					
80	.0	254	78	7.5	64	1770	1350	0	101	22	510	320	0
90	.1	252	102	8.6	69	2490	2110	1800					
100	.2	250	123	9.5	73	3270	2890	4900					
100	.0	171	90	9.8	73	2400	2130	4000	79	33	870	760	900
110	.1	170	108	10.8	77	3080	2800	8000					
120	.1	170	127	11.7	80	3810	3500	12300					
120	.0	56	54	13.3	82	1660	1550	5900	114	73	2150	1950	6400
130	.1	56	66	14.7	85	2110	1990	8200					
140	.1	56	78	16.0	87	2590	2460	10700					
140	.0	15	26	17.9	89	890	860	4000	41	52	1700	1600	6700
150	.1	15	32	19.8	92	1120	1080	5500					
160	.1	15	38	21.6	93	1370	1330	7200					
							TOTAL YIELDS				6910	5960	21200

MERCH. CU. FT. = TREES 6.0 INCHES D.B.H. AND LARGER TO 4.0-INCH TOP.
BD. FT. = TREES 10.0 INCHES D.B.H. AND LARGER TO VARIABLE TOP LIMIT.
INITIAL THINNING MUST BE FROM BELOW.
DWARF MISTLETOE RATING ABOVE WHICH PERIODIC THINNINGS WILL NOT BE EXECUTED = 3.0.
MINIMUM CUTS FOR INCLUSION IN TOTAL YIELDS-- 260. CUBIC FEET AND 500. BOARD FEET.
PRECOMMERCIAL INITIAL THINNING ALLOWED, NONCOMMERCIAL SUBSEQUENT THINNINGS NOT ALLOWED.
AT INITIAL AGE 60., 35. PERCENT OF THE TREES WERE INFECTED WITH DWARF MISTLETOE.

Table 2

YIELDS PER ACRE OF SOUTHWESTERN PONDEROSA PINE, STAND NUMBER 2.

SITE INDEX 71
THINNING INTENSITY-- INITIAL= 80. SUBSEQUENT= 100.

COCONINO NF LONG VALLEY RD YELLOWJACKET BEFORE THINNING 1975

	CHARACTERISTICS BEFORE AND AFTER THINNING								PERIODIC INTERMEDIATE CUTS				
STAND AGE (YEARS)	DMR	TREES NO.	BASAL AREA SQ.FT.	AVERAGE D.B.H. IN.	AVERAGE HEIGHT FT.	TOTAL VOLUME CU.FT.	MERCHANTABLE VOLUME CU.FT.	SAWTIMBER VOLUME BD.FT.	TREES NO.	BASAL AREA SQ.FT.	TOTAL VOLUME CU.FT.	MERCHANTABLE VOLUME CU.FT.	SAWTIMBER VOLUME BD.FT.
60	.4	538	57	4.4	50	1230	0	0					
60	.0	360	43	4.7	51	920	0	0	178	14	310	0	0
70	.2	358	73	6.1	57	1570	830	0					
80	.2	355	100	7.2	63	2280	1670	0					
80	.2	355	100	7.2	63	2280	1670	0	0	0	0	0	0
90	.7	350	125	8.1	68	3000	2450	1300					
100	1.1	343	148	8.9	72	3890	3360	4200					
100	.5	208	98	9.3	73	2600	2280	3300	135	50	1290	1080	900
110	.9	207	117	10.2	77	3320	2990	6900					
120	1.4	207	137	11.0	80	4060	3700	11700					
120	.4	70	60	12.5	82	1820	1680	6200	137	77	2240	2020	5500
130	.8	70	73	13.8	84	2310	2170	8500					
140	1.2	70	86	15.0	87	2820	2670	11100					
140	.1	19	30	16.9	89	1000	950	4300	51	56	1820	1720	6800
150	.3	19	36	18.7	91	1260	1210	5900					
160	.5	19	43	20.4	93	1530	1490	7700					
							TOTAL YIELDS				7190	6310	20900

MERCH. CU. FT. = TREES 6.0 INCHES D.B.H. AND LARGER TO 4.0-INCH TOP.
BD. FT. = TREES 10.0 INCHES D.B.H. AND LARGER TO VARIABLE TOP LIMIT.
INITIAL THINNING MUST BE FROM BELOW.
DWARF MISTLETOE RATING ABOVE WHICH PERIODIC THINNINGS WILL NOT BE EXECUTED = 3.0.
MINIMUM CUTS FOR INCLUSION IN TOTAL YIELDS-- 260. CUBIC FEET AND 500. BOARD FEET.
PRECOMMERCIAL INITIAL THINNING ALLOWED, NONCOMMERCIAL SUBSEQUENT THINNINGS NOT ALLOWED.
AT INITIAL AGE 60., 35. PERCENT OF THE TREES WERE INFECTED WITH DWARF MISTLETOE.
NOTE THAT NOT ALL SCHEDULED THINNINGS WERE POSSIBLE.

Table 3

YIELDS PER ACRE OF SOUTHWESTERN PONDEROSA PINE, STAND NUMBER 2.

SITE INDEX 71
THINNING INTENSITY-- INITIAL- 100. SUBSEQUENT- 90.

COCONINO NF LONG VALLEY RD YELLOWJACKET BEFORE THINNING 1975

CHARACTERISTICS BEFORE AND AFTER THINNING									PERIODIC INTERMEDIATE CUTS				
STAND AGE (YEARS)	DMR	TREES NO.	BASAL AREA SQ.FT.	AVERAGE D.B.H. IN.	AVERAGE HEIGHT FT.	TOTAL VOLUME CU.FT.	MERCHANTABLE VOLUME CU.FT.	SAWTIMBER VOLUME BD.FT.	TREES NO.	BASAL AREA SQ.FT.	TOTAL VOLUME CU.FT.	MERCHANTABLE VOLUME CU.FT.	SAWTIMBER VOLUME BD.FT.
60	.4	538	57	4.4	50	1230	0	0					
60	.1	464	51	4.5	50	1100	0	0	74	6	130	0	0
70	.5	461	85	5.8	57	1840	830	0					
80	1.0	455	115	6.8	63	2630	1780	0					
80	.3	266	75	7.2	64	1720	1260	0	189	40	910	520	0
90	.8	264	99	8.3	69	2380	1980	1200					
100	1.2	262	121	9.2	73	3190	2790	4000					
100	.7	181	89	9.5	73	2370	2090	3300	81	32	820	700	700
110	1.1	180	108	10.5	77	3070	2780	7100					
120	2.0	165	117	11.4	80	3490	3200	11200					
120	1.1	59	54	12.9	82	1640	1520	5700	106	63	1850	1680	5500
130	1.8	55	61	14.3	85	1960	1840	7400					
140	2.5	50	66	15.6	87	2190	2080	8800					
140	1.5	17	27	17.2	89	930	890	4000	33	39	1260	1190	4800
150	1.9	17	34	19.1	91	1170	1130	5600					
160	2.2	17	41	20.9	93	1440	1400	7400					
						TOTAL YIELDS					6410	5490	18400

MERCH. CU. FT. - TREES 6.0 INCHES D.B.H. AND LARGER TO 4.0-INCH TOP.
BD. FT. - TREES 10.0 INCHES D.B.H. AND LARGER TO VARIABLE TOP LIMIT.
INITIAL THINNING MUST BE FROM BELOW.
DWARF MISTLETOE RATING ABOVE WHICH PERIODIC THINNINGS WILL NOT BE EXECUTED - 3.0.
MINIMUM CUTS FOR INCLUSION IN TOTAL YIELDS-- 260. CUBIC FEET AND 500. BOARD FEET.
PRECOMMERCIAL INITIAL THINNING ALLOWED. NONCOMMERCIAL SUBSEQUENT THINNINGS NOT ALLOWED.
AT INITIAL AGE 60., 35. PERCENT OF THE TREES WERE INFECTED WITH DWARF MISTLETOE.

Table 4

YIELDS PER ACRE OF SOUTHWESTERN PONDEROSA PINE, STAND NUMBER 2.

SITE INDEX 71
THINNING INTENSITY-- INITIAL- 160. SUBSEQUENT- 100.

COCONINO NF LONG VALLEY RD YELLOWJACKET BEFORE THINNING 1975

	CHARACTERISTICS BEFORE AND AFTER THINNING								PERIODIC INTERMEDIATE CUTS				
STAND AGE (YEARS)	DMR	TREES NO.	BASAL AREA SQ.FT.	AVERAGE D.B.H. IN.	AVERAGE HEIGHT FT.	TOTAL VOLUME CU.FT.	MERCHANTABLE VOLUME CU.FT.	SAWTIMBER VOLUME BD.FT.	TREES NO.	BASAL AREA SQ.FT.	TOTAL VOLUME CU.FT.	MERCHANTABLE VOLUME CU.FT.	SAWTIMBER VOLUME BD.FT.
60	.4	538	57	4.4	50	1230	0	0					
60	.4	538	57	4.4	50	1230	0	0	0	0	0	0	0
70	.9	534	95	5.7	57	2070	880	0					
80	1.5	525	125	6.6	63	2860	1850	0					
80	.7	306	82	7.0	63	1870	1320	0	219	43	990	530	0
90	1.1	304	106	8.0	68	2550	2060	0					
100	2.0	275	119	8.9	73	3110	2680	3100					
100	1.6	212	98	9.2	73	2580	2260	3000	63	21	530	420	100
110	2.5	189	105	10.1	77	2960	2660	5800					
120	3.3	161	106	11.0	80	3140	2860	8700					
120	2.5	74	60	12.2	81	1810	1670	6100	87	46	1330	1190	2600
130	3.3	64	64	13.5	84	2000	1870	7200					
140	4.1	53	63	14.8	86	2060	1950	8000					
140	3.1	21	30	16.2	88	1000	950	4200	32	33	1060	1000	3800
150	3.6	21	37	18.0	90	1270	1220	5800					
160	4.0	21	44	19.7	92	1560	1510	7600					
						TOTAL YIELDS					5470	4650	14000

MERCH. CU. FT. = TREES 6.0 INCHES D.B.H. AND LARGER TO 4.0-INCH TOP.
BD. FT. = TREES 10.0 INCHES D.B.H. AND LARGER TO VARIABLE TOP LIMIT.
INITIAL THINNING MUST BE FROM BELOW.
DWARF MISTLETOE RATING ABOVE WHICH PERIODIC THINNINGS WILL NOT BE EXECUTED = 3.0.
MINIMUM CUTS FOR INCLUSION IN TOTAL YIELDS-- 200. CUBIC FEET AND 500. BOARD FEET.
PRECOMMERCIAL INITIAL THINNING ALLOWED, NONCOMMERCIAL SUBSEQUENT THINNINGS NOT ALLOWED.
AT INITIAL AGE 60., 35. PERCENT OF THE TREES WERE INFECTED WITH DWARF MISTLETOE.
NOTE THAT NOT ALL SCHEDULED THINNINGS WERE POSSIBLE.

Table 5

YIELDS PER ACRE OF SOUTHWESTERN PONDEROSA PINE, STAND NUMBER 1.

SITE INDEX 63
THINNING INTENSITY-- INITIAL- 70. SUBSEQUENT- 100.

COCONINO NF BLUE RIDGE RD AZTEC SECTION BEFORE THINNING 1975

STAND AGE (YEARS)	DMR	CHARACTERISTICS BEFORE AND AFTER THINNING: TREES NO.	BASAL AREA SQ.FT.	AVERAGE D.B.H. IN.	AVERAGE HEIGHT FT.	TOTAL VOLUME CU.FT.	MERCHANTABLE VOLUME CU.FT.	SAWTIMBER VOLUME BD.FT.	PERIODIC INTERMEDIATE CUTS: TREES NO.	BASAL AREA SQ.FT.	TOTAL VOLUME CU.FT.	MERCHANTABLE VOLUME CU.FT.	SAWTIMBER VOLUME BD.FT.
40	.1	2032	44	2.0	30	1550	0	0					
40	.0	465	15	2.4	32	410	0	0	1567	29	1140	0	0
50	.1	463	51	4.5	40	930	0	0					
60	.1	460	84	5.8	46	1530	690	0					
60	.0	361	71	6.0	46	1280	640	0	99	13	250	50	0
70	.1	358	96	7.0	53	1850	1310	0					
80	.1	354	121	7.9	58	2490	2000	800					
80	.0	251	92	8.2	58	1910	1570	800	103	29	580	430	0
90	.1	249	112	9.1	63	2530	2210	2900					
100	.1	246	132	9.9	67	3210	2860	5900					
100	.0	176	100	10.2	67	2450	2210	5000	70	32	760	650	900
110	.1	176	118	11.1	71	3090	2820	9000					
120	.1	176	134	11.8	74	3670	3380	12000					
120	.0	50	50	13.6	76	1430	1340	5200	126	84	2240	2040	6800
130	.1	50	61	15.0	78	1810	1710	7100					
140	.1	50	72	16.2	81	2190	2080	9100					
							TOTAL YIELDS				7160	5200	16800

MERCH. CU. FT. - TREES 6.0 INCHES D.B.H. AND LARGER TO 4.0-INCH TOP.
BD. FT. - TREES 10.0 INCHES D.B.H. AND LARGER TO VARIABLE TOP LIMIT.
INITIAL THINNING MUST BE FROM BELOW.
DWARF MISTLETOE RATING ABOVE WHICH PERIODIC THINNINGS WILL NOT BE EXECUTED - 3.0.
MINIMUM CUTS FOR INCLUSION IN TOTAL YIELDS-- 260. CUBIC FEET AND 500. BOARD FEET.
ALL THINNINGS MAY BE NONCOMMERCIAL.
AT INITIAL AGE 40., 5. PERCENT OF THE TREES WERE INFECTED WITH DWARF MISTLETOE.

Table 6

YIELDS PER ACRE OF SOUTHWESTERN PONDEROSA PINE, STAND NUMBER 1.

SITE INDEX 65
THINNING INTENSITY-- INITIAL- 80. SUBSEQUENT- 80.

COCONINO NF BLUE RIDGE RD AZTEC SECTION BEFORE THINNING 1975

CHARACTERISTICS BEFORE AND AFTER THINNING									PERIODIC INTERMEDIATE CUTS				
STAND AGE (YEARS)	DMR	TREES NO.	BASAL AREA SQ.FT.	AVERAGE D.B.H. IN.	AVERAGE HEIGHT FT.	TOTAL VOLUME CU.FT.	MERCHANTABLE VOLUME CU.FT.	SAWTIMBER VOLUME BD.FT.	TREES NO.	BASAL AREA SQ.FT.	TOTAL VOLUME CU.FT.	MERCHANTABLE VOLUME CU.FT.	SAWTIMBER VOLUME BD.FT.
40	.1	2032	44	2.0	30	1550	0	0					
40	.0	532	17	2.4	32	460	0	0	1500	27	1090	0	0
50	.1	529	56	4.4	40	1020	0	0					
50	.1	529	56	4.4	40	1020	0	0	0	0	0	0	0
60	.1	525	90	5.6	46	1640	660	0					
60	.1	525	90	5.6	46	1640	660	0	0	0	0	0	0
70	.6	517	119	6.5	52	2330	1460	0					
70	.0	245	65	7.0	53	1280	900	0	272	54	1050	560	0
80	.2	244	87	8.1	59	1810	1480	700					
80	.2	244	87	8.1	59	1810	1480	700	0	0	0	0	0
90	.3	242	107	9.0	63	2400	2080	2500					
90	.0	166	78	9.3	64	1780	1560	2100	76	29	620	520	400
100	.1	165	95	10.3	68	2350	2120	4900					
100	.0	133	80	10.5	68	1980	1790	4400	32	15	370	330	500
110	.1	133	96	11.5	71	2530	2320	8200					
110	.0	107	80	11.7	72	2120	1940	6900	26	16	410	380	1300
120	.1	107	94	12.7	75	2620	2430	9000					
120	.0	36	40	14.3	76	1150	1080	4300	71	54	1470	1350	4700
130	.1	36	49	15.8	79	1460	1390	6000					
140	.1	36	58	17.2	81	1790	1710	7800					
							TOTAL YIELDS				6800	4850	14300

MERCH. CU. FT. = TREES 6.0 INCHES D.B.H. AND LARGER TO 4.0-INCH TOP.
BD. FT. = TREES 10.0 INCHES D.B.H. AND LARGER TO VARIABLE TOP LIMIT.
INITIAL THINNING MUST BE FROM BELOW.
DWARF MISTLETOE RATING ABOVE WHICH PERIODIC THINNINGS WILL NOT BE EXECUTED = 3.0.
MINIMUM CUTS FOR INCLUSION IN TOTAL YIELDS-- 250. CUBIC FEET AND 500. BOARD FEET.
PRECOMMERCIAL INITIAL THINNING ALLOWED. NONCOMMERCIAL SUBSEQUENT THINNINGS NOT ALLOWED.

AT INITIAL AGE 40., 5. PERCENT OF THE TREES WERE INFECTED WITH DWARF MISTLETOE.
NOTE THAT NOT ALL SCHEDULED THINNINGS WERE POSSIBLE.

Table 7

YIELDS PER ACRE OF SOUTHWESTERN PONDEROSA PINE, STAND NUMBER 1.

SITE INDEX 63
THINNING INTENSITY-- INITIAL= 70, SUBSEQUENT= 100,

COCONINO NF BLUE RIDGE RD AZTEC SECTION BEFORE THINNING 1975

		CHARACTERISTICS BEFORE AND AFTER THINNING							PERIODIC INTERMEDIATE CUTS				
STAND AGE (YEARS)	DMR	TREES NO.	BASAL AREA SQ.FT.	AVERAGE D.B.H. IN.	AVERAGE HEIGHT FT.	TOTAL VOLUME CU.FT.	MERCHANTABLE VOLUME CU.FT.	SAWTIMBER VOLUME BD.FT.	TREES NO.	BASAL AREA SQ.FT.	TOTAL VOLUME CU.FT.	MERCHANTABLE VOLUME CU.FT.	SAWTIMBER VOLUME BD.FT.
40	.1	2032	44	2.0	30	1550	0	0					
40	.0	465	15	2.4	32	410	0	0	1567	29	1140	0	0
50	.1	463	51	4.5	40	930	0	0					
60	.1	460	84	5.8	46	1530	690	0					
60	.0	361	71	6.0	46	1280	640	0	99	13	250	50	0
70	.1	358	96	7.0	53	1850	1310	0					
80	.1	354	121	7.9	58	2490	2000	800					
80	.0	251	92	8.2	58	1910	1570	800	103	29	580	430	0
90	.1	249	112	9.1	63	2530	2210	2900					
100	.1	246	132	9.9	67	3210	2860	5900					
100	.0	85	60	11.4	69	1520	1390	4600	161	72	1690	1470	1300
110	.1	85	74	12.6	72	1970	1830	6800					
120	.1	85	87	13.7	75	2450	2290	8900					
120	.0	23	31	15.6	77	890	840	3600	62	56	1560	1450	5300
130	.1	23	38	17.3	80	1130	1090	5000					
140	.1	23	45	18.9	82	1400	1350	6600					
						TOTAL YIELDS					6620	4700	13200

MERCH. CU. FT. = TREES 6.0 INCHES D.B.H. AND LARGER TO 4.0-INCH TOP.
BD. FT. = TREES 10.0 INCHES D.B.H. AND LARGER TO VARIABLE TOP LIMIT.
INITIAL THINNING MUST BE FROM BELOW.
DWARF MISTLETOE RATING ABOVE WHICH PERIODIC THINNINGS WILL NOT BE EXECUTED = 3.0.
MINIMUM CUTS FOR INCLUSION IN TOTAL YIELDS-- 260. CUBIC FEET AND 500. BOARD FEET.
ALL THINNINGS MAY BE NONCOMMERCIAL.
AT INITIAL AGE 40., 5. PERCENT OF THE TREES WERE INFECTED WITH DWARF MISTLETOE.

Table 8

YIELDS PER ACRE OF SOUTHWESTERN PONDEROSA PINE, STAND NUMBER 1.

SITE INDEX 63

THINNING INTENSITY-- INITIAL- 80. SUBSEQUENT- 120.

COCONINO NF BLUE RIDGE RD AZTEC SECTION BEFORE THINNING 1975

CHARACTERISTICS BEFORE AND AFTER THINNING									PERIODIC INTERMEDIATE CUTS				
STAND AGE (YEARS)	DMR	TREES NO.	BASAL AREA SQ.FT.	AVERAGE D.B.H. IN.	AVERAGE HEIGHT FT.	TOTAL VOLUME CU.FT.	MERCHANTABLE VOLUME CU.FT.	SAWTIMBER VOLUME BD.FT.	TREES NO.	BASAL AREA SQ.FT.	TOTAL VOLUME CU.FT.	MERCHANTABLE VOLUME CU.FT.	SAWTIMBER VOLUME BD.FT.
40	.1	2032	44	2.0	30	1550	0	0					
40	.0	532	17	2.4	32	460	0	0	1500	27	1090	0	0
50	.1	529	56	4.4	40	1020	0	0					
60	.1	525	90	5.6	46	1640	660	0					
60	.1	525	90	5.6	46	1640	660	0	0	0	0	0	0
70	.6	517	119	6.5	52	2330	1460	0					
80	1.0	503	142	7.2	57	2970	2170	0					
80	.5	338	104	7.5	58	2160	1650	0	165	38	810	520	0
90	1.0	334	125	8.3	62	2760	2290	1600					
100	1.4	327	144	9.0	66	3460	3000	4000					
100	.8	137	72	9.8	67	1740	1550	2800	190	72	1720	1450	1200
110	1.3	136	88	10.9	70	2280	2080	6000					
120	2.1	120	91	11.8	73	2480	2280	8100					
120	1.1	36	36	13.5	75	1010	940	3600	84	55	1470	1340	4500
130	1.8	33	41	15.1	78	1200	1140	4700					
140	2.4	29	44	16.6	80	1320	1260	5600					
							TOTAL YIELDS				6410	4570	11300

MERCH. CU. FT. = TREES 6.0 INCHES D.B.H. AND LARGER TO 4.0-INCH TOP.
BD. FT. = TREES 10.0 INCHES D.B.H. AND LARGER TO VARIABLE TOP LIMIT.
INITIAL THINNING MUST BE FROM BELOW.
DWARF MISTLETOE RATING ABOVE WHICH PERIODIC THINNINGS WILL NOT BE EXECUTED = 3.0.
MINIMUM CUTS FOR INCLUSION IN TOTAL YIELDS-- 260. CUBIC FEET AND 500. BOARD FEET.
PRECOMMERCIAL INITIAL THINNING ALLOWED, NONCOMMERCIAL SUBSEQUENT THINNINGS NOT ALLOWED.
AT INITIAL AGE 40., 5. PERCENT OF THE TREES WERE INFECTED WITH DWARF MISTLETOE.
NOTE THAT NOT ALL SCHEDULED THINNINGS WERE POSSIBLE.

Table 9

YIELDS PER ACRE OF SOUTHWESTERN PONDEROSA PINE, STAND NUMBER 1.

SITE INDEX 63
THINNING INTENSITY-- INITIAL- 80. SUBSEQUENT- 120.

COCONINO NF BLUE RIDGE RD AZTEC SECTION BEFORE THINNING 1975

		CHARACTERISTICS BEFORE AND AFTER THINNING							PERIODIC INTERMEDIATE CUTS				
STAND AGE (YEARS)	DMR	TREES NO.	BASAL AREA SQ.FT.	AVERAGE D.B.H. IN.	AVERAGE HEIGHT FT.	TOTAL VOLUME CU.FT.	MERCHANTABLE VOLUME CU.FT.	SAWTIMBER VOLUME BD.FT.	TREES NO.	BASAL AREA SQ.FT.	TOTAL VOLUME CU.FT.	MERCHANTABLE VOLUME CU.FT.	SAWTIMBER VOLUME BD.FT.
40	.1	2032	44	2.0	30	1550	0	0					
40	.0	552	17	2.4	32	460	0	0	1500	27	1090	0	0
50	.1	529	56	4.4	40	1020	0	0					
60	.1	525	90	5.6	46	1640	660	0					
60	.1	525	90	5.6	46	1640	660	0	0	0	0	0	0
70	.6	517	119	6.5	52	2330	1460	0					
80	1.0	503	142	7.2	57	2970	2170	0					
80	.5	338	104	7.5	58	2160	1650	0	165	38	810	520	0
90	1.0	334	125	8.3	62	2760	2290	1600					
100	1.4	327	144	9.0	66	3460	3000	4000					
100	1.0	250	118	9.3	67	2840	2500	3700	77	26	620	500	300
110	1.9	221	121	10.0	70	3090	2760	5900					
120	2.8	187	117	10.7	73	3150	2860	8000					
120	1.9	76	60	12.0	75	1650	1520	5400	111	57	1500	1340	2600
130	2.7	66	63	13.2	77	1810	1690	6400					
140	3.5	55	62	14.4	79	1860	1750	7100					
							TOTAL YIELDS				5880	4110	9700

MERCH. CU. FT. - TREES 6.0 INCHES D.B.H. AND LARGER TO 4.0-INCH TOP.
BD. FT. - TREES 10.0 INCHES D.B.H. AND LARGER TO VARIABLE TOP LIMIT.
INITIAL THINNING MUST BE FROM BELOW.
DWARF MISTLETOE RATING ABOVE WHICH PERIODIC THINNINGS WILL NOT BE EXECUTED - 3.0.
MINIMUM CUTS FOR INCLUSION IN TOTAL YIELDS-- 260. CUBIC FEET AND 500. BOARD FEET.
PRECOMMERCIAL INITIAL THINNING ALLOWED. NONCOMMERCIAL SUBSEQUENT THINNINGS NOT ALLOWED.
AT INITIAL AGE 40., 5. PERCENT OF THE TREES WERE INFECTED WITH DWARF MISTLETOE.
NOTE THAT NOT ALL SCHEDULED THINNINGS WERE POSSIBLE.

Table 10